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Abstract

THE ROLE OF WINDSCALE ADVANCED GAS COOLED REACTOR IN THE DEVELOPMENT OF A COMMERCIAL POWER SYSTEM

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Operating experience obtained during the first year's operation of the Windscale Advanced Gas Cooled Reactor (WAGR) is described and the role of the reactor and its supporting research facilities in the development programme are highlighted in a programme chart. The design and commissioning of the reactor are not described and readers interested in them are referred to the proceedings of the Symposium on the Advanced Gas Cooled Reactor sponsored by the British Nuclear Engineering Society and held in March 1963.

Operational experience with the WAGR is reviewed in the light of its application to the design and operation of a commercial reactor with specific reference to:-

(a) high integrity of the plant leading to high utilisation and the ability to achieve substantial increases in output over design figures
(b) satisfactory experience with the instrumentation and control systems
(c) behaviour of plant components, in particular those of a novel nature
(d) experience with installed safety circuits.

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A section on the reactor core discusses the problem of planning reactor loading patterns and fuel cycles, and experience with the computer programmes used for the WAGR and presently being developed for commercial AGR cores.

The utilisation of the reactor and the independent loop circuits for the following experimental purposes is described.

(a) As a fuel test bed to test a number of fuel design features in addition to irradiation of fuel representative of commercial AGR designs. The loop circuits are used for experiments of a more advanced nature for example the behaviour of a fuel element containing a simulated burst was studied in a loop prior to its transfer to the main core.

(b) To monitor the graphite core for core movements and for dimensional changes in diameter and length. The reactor and the loops have been used for experiments with different gas mixtures to determine the optimum coolant gas composition and to obtain data on the effects of irradiation on the physical properties of graphite.

(c) Short transient, oscillator, noise and fault simulation experiments have provided data on temperature coefficients and behaviour of the auto control system and permitted predictions relevant to major fault conditions in the WAGR and commercial AGRs. Long term reactivity changes are measured as burn-up proceeds and compared with the results from calculations.

(d) Basic methods for physics calculations are tested against data derived from experiments on sub-critical facilities, from the WAGR during operation and from post-irradiation examination of fuel.